cations in the higher frequency layer can correspond to performing mmW communications.

[0040] In order to offload traffic to a higher frequency layer/channel, one embodiment of the present invention offloads the traffic to a component carrier in a higher frequency. The component carrier in the higher frequency can be in a higher frequency above 6 GHz, for example. However, a user equipment (UE) may need to continuously monitor these high-frequency component carrier(s) to determine when the offloading is possible. Because the propagation characteristics of high frequency resources can experience heavier signal deterioration within obstructed environments, communication using frequencies above 6 GHz (such as mmW communication) may require the presence of a short-range Line-Of-Sight (LOS) link.

[0041] In view of the above, one embodiment of the present invention establishes a first connection (a baseline connectivity) which transmits communication via a lower-frequency channel/band (such as sub-6 GHz bands). While the first connection/channel is implemented, measurements conducted on the lower-frequency channel/band can be used to determine if offloading communication to a higher-frequency channel/band is feasible. The measurements can be conducted on the signal characteristics/channel information of the lower-frequency bands. These measurements can then be used to infer whether the conditions of the high-frequency channels/bands are favorable for offloading traffic to the high-frequency channels/bands.

[0042] In view of the above, one embodiment of the present invention can measure the signal characteristics/channel information corresponding to a signal received from a base station via lower-frequency bands. The embodiment can then use these measurements to infer the high-frequency channel conditions for the same base station.

[0043] Similarly, another embodiment of the present invention can measure the signal characteristics/channel information corresponding to a signal received from a device via lower-frequency bands. The embodiment can then use these measurements to infer the high-frequency channel conditions for the same device.

[0044] However, if a communication system continually conducts measurements to determine whether offloading communication is feasible, the continual conducting of measurements can cause unnecessary energy-consumption by the communication system. Therefore, it would be generally beneficial if unnecessary measurements can be reduced in order to save energy.

[0045] In view of the above considerations, in one embodiment of the present invention, a user equipment can periodically monitor/scan the high-frequency carriers/high-frequency channels, as opposed to continually monitoring/scanning the channels of high frequency carriers. The user equipment can periodically monitor/scan the high-frequency carriers according to a determined rate of occurrence. The determined rate of occurrence can be dynamically tuned according to received signal characteristics/channel information.

[0046] Examples of received signal characteristics/channel information can include a reference-signal-strength indicator (RSSI) (such as reference-signal-received-power (RSRP) in 3 GPP LTE technology), and/or a delay spread indicator (such as a root-mean-square (RMS) delay spread), and/or a proportion of channel impulse response energy (CIR) (such as a proportion of CIR energy in a first tap of a CIR).

[0047] With regard to the CIR taps received by a UE, if a transmitting node such as a base station or a relay or a device transmits a signal to the UE, the signal can directly reach the UE and can also reach the UE after being reflected by various obstacles in between the transmitting node and the UE. The same phenomenon can also be experienced when the UE transmits to a receiver node such as a base station or a relay or a device. The energy of a first tap is generally considered to be the amount of energy corresponding to the signal that was directly received by the UE from the base station (such as the base station transmits to the UE), in the event that a LOS condition exists. If a proportion of CIR energy in a first tap indicates that a large proportion of the energy was received in the first tap (as opposed to being received in subsequent taps corresponding to instances of reflected signals), then offloading of the communication to a higher-frequency level is more likely to be feasible, as described in more detail below.

[0048] Channel information can be obtained from the values of parameters which represent the attenuation, phase change and delay in the received signal relative to the transmitted signal, due to radio channel conditions between transmitter and receiver.

[0049] In one embodiment, the received signal characteristics/channel information can be received via the low-frequency component carrier. The received signal characteristics/channel information can also be measured while the communication system transmits communication via the low-frequency component carrier. As discussed above, the measurements conducted can be used to ascertain whether it is feasible to switch on-going communications to the high-frequency component carrier.

[0050] In another embodiment, the rate of occurrence for scanning/monitoring the high-frequency component carrier can be tuned and configured by a base station, or can be tuned autonomously by a UE. Either the UE or a base station can receive and/or measure the signal characteristics/channel information of the low-frequency carrier. The base station can also be replaced by another node, such as a different device or relay.

[0051] In another embodiment, the rate of occurrence for scanning/monitoring the high-frequency component carrier for the communications between two nodes (such as D2D communications) can be tuned and configured by a third node (such as a base station or a third UE).

[0052] In another embodiment, to determine a rate of occurrence for monitoring the high-frequency carrier, a result of the prediction history (such as a success rate of predictions made previously), and/or a quality of service indicator of the high-frequency channel (such as throughput/delay/signal quality/signal strength), and/or a load indicator of the high-frequency channel can be used in addition to the results of predicting based on signal characteristics/channel information of the low-frequency carrier.

[0053] In another embodiment, once the measurements are completed, if the received signal characteristics/channel information (measured in the low-frequency carrier) indicate that the high-frequency channels/bands are not suitable for offloading the wireless communication upon, the rate of occurrence for monitoring the high-frequency channels/bands can be reduced. In another embodiment, if the high-frequency channels/bands do not appear to be suitable for offloading the wireless communication upon, the radio frequency and baseband units dedicated for the high frequencies can be switched off, thus conserving energy.